Abstract

The aim of the present meta-analysis was to determine whether there are any differences between eye movement desensitisation and reprocessing (EMDR) and trauma-focused cognitive behaviour therapy (TFCBT) for post-traumatic stress disorder (PTSD) with respect to efficacy and efficiency. We performed a comprehensive literature search using several electronic search engines as well as manual searches of other review papers. Eight original studies involving 227 participants were identified in this manner. The results showed no difference between EMDR or TFCBT on measures of PTSD. However, there was a significant advantage for EMDR over TFCBT in reducing depression (Hedge's g= .63). The analysis also indicated a difference in the prescribed homework between the treatments. Meta-regression analyses were conducted to examine the relationship between hours of homework and gains in depression and PTSD symptoms. Conclusions were confounded by differences between the treatments. These findings are discussed in terms of efficacy and cost-effectiveness.

Conflict of interest: The second author receives payments for CBT and EMDR trainings.

Keywords: EMDR; exposure; TFCBT; homework; eye movements; mechanism of action.

Introduction

The recommended first line treatment for post-traumatic stress disorder (PTSD) is either Eye Movement Desensitisation and Reprocessing (EMDR) or Trauma-Focused Cognitive Behaviour Therapy (TFCBT; Bisson & Andrew, 2009). These two therapies work well when compared with a wait-list control (Hogberg et al., 2006; Resick, Nishith, Weaver, Astin, & Feuer, 2002) against other forms of accepted practices for PTSD (e.g. supported counselling; Foa et al., 1999) and also when they are directly compared against each other (Devilly & Spence, 1999; Rothbaum, Astin, & Marsteller, 2005). This attests to the robustness of findings for both. Currently the mechanism of action for the effectiveness of EMDR remains controversial, hence it has been suggested that EMDR is a variant of TFCBT as both share key elements of exposure and cognitive processing (Australian Centre for Posttraumatic Mental Health, 2007; Lohr, Tolin, & Lilienfeld, 1998). Similarities between the two approaches include a cognitive component, imaginal templating (rehearsal of coping responses to future stressors) and exposure (Lohr, et al., 1998). However these differences are superficial especially if one considers the procedures and the assumed processes that are involved.

According to Shapiro (2001), EMDR alleviates distress by facilitating access to the traumatic memory network and allowing this consolidation to occur by forging associations between the traumatic memory and more adaptive memories or information. The memory of the traumatic event is initially accessed by having the client identify the dominant visual image, associated negative cognitions, affect and body sensations as well as a more positive and adaptive cognition. Whilst the client focuses on these images, negative cognitions affect and body sensations, they simultaneously engage in therapist directed eye movements for

approximately 24 seconds. Associations are then elicited and they become the focus of the next set of dual-attention processing. This sequence is repeated numerous times throughout the session, following standardised procedures with the associations usually becoming more and more adaptive as the session progresses. When the initial memory no longer triggers any distress and the client is able to endorse an associated positive self-referencing cognition, the process is repeated with related current triggers and future apprehensions, ensuring that all past, present and future aspects of the memory network are fully resolved and transformed (Shapiro, 2001).

TFCBT utilises traditional techniques of exposure which can be accomplished via systematic desensitisation whereby the client is taught to pair the traumatic memory with anxigoenic-incompatible behaviour, such as slow breathing (Brewer, 2001) or prolonged exposure (PE) which involves direct confrontation with the threatening stimulus (Foa & Rothbaum, 1998). Avoidance is prevented at all costs to ensure habituation occurs. Exposure in this instance is long and sustained, requiring patients to relive the memory or confront the threat for at least 60 minutes duration in session and then also for homework. In contrast, although reliving often occurs during EMDR the dual attention processing eventually creates a sense of distance and mindfulness (Lee, Taylor & Drummond, 2006) . The occurrence of free association is thought to demonstrate successful consolidation between the event and the client's current knowledge networks (Lee, 2006; Lee et al., 2008; Rogers & Silver, 2002). These processes would be considered avoidance in PE and an hindrance to treatment progress (Foa & Rothbaum, 1998).

How these mechanisms, in particular the eye movements aid the therapeutic process is uncertain, though some proponents suggest that there is a psychophysiological response with respect to autonomic changes (see Elofsson, von Scheele, Theorell, & Sondergaard, 2008; Sack, Lempa, Steinmetz, Lamprecht, & Hofmann, 2008 for more information). Perhaps the most researched and supported model for the mechanism of eye movements in EMDR is the Working Memory model. This model assumes that because the two tasks of focusing on a distressing memory and making eye movements is sufficient to tax the working memory system during retrieval – the vividness and emotionality of the visual images is reduced (I. M. Engelhard, M. van den Hout, & A. M. Smeets, 2011; Engelhard, van den Hout, Janssen, & van der Beek, 2010).

This was confirmed by Gunter and Bodner (2008) who found that participants who engaged in eye movements whilst holding an unpleasant memory in mind experienced a reduction in vividness, emotionality and completeness compared with those participants who engaged in eye movements after thinking about the event. This degraded memory is thought to be more agreeable to focus on and thus reprocessing can occur. The degraded memory may also elicit other memories (free association) hence allowing further integration. According to the working memory model though, any task that can sufficiently stretch the resources of the working memory pool can be used to disrupt traumatic memories, consequently the eye movements cannot be considered to have a unique effect as drawing complex shapes has been found to also decrease the vividness of emotional memories (Gunter & Bodner, 2008). Perhaps what may be unique about the eye movements is their ability to reduce the distressing nature of "*flashfowards*" – vivid and emotional images about feared future events. Engelhard, et al., (2010) explored this in a non-clinical sample whose ratings for feared

future images significantly decreased in vividness and emotionality during the eye movement condition and not in the no dual task condition. Whichever it may be, there is now mounting evidence for the role of eye movements in EMDR and therefore further evidence that it is not a variant of CBT-based approaches

The fact that there is little to no homework assigned in EMDR is also puzzling, as homework is considered to be a necessary and vital component of most psychotherapeutic endeavours, particularly CBT. A recent a meta-analysis by Kazantzis, Whittington & Dattilio, (2010) of 46 studies (n = 1,072), directly contrasting therapies with and without homework produced a small to medium effect size in favour of therapy with homework. The authors conclude that homework assignments are clearly beneficial and increase the effectiveness of therapies which are already clinically robust. This conclusion may not be applicable to all treatments though. Indeed the meta-analysis by Kazantzis et al., (2010) did not include studies of EMDR, a treatment known for its minimal homework requirements. Studies comparing CBT and EMDR reveal number of sessions to be comparable (Lee, Gavriel, Drummond, Richards, & Greenwald, 2002; Power et al., 2002), as well as treatment outcomes (in some cases EMDR has proven to be superior e.g. Ironson, Freund, Strauss, & Williams, 2002) however hours of homework assigned to the study participants are not.

The homework component in EMDR has never before been systematically studied. Presumptions insisting that EMDR is more efficient sprung from an earlier meta-analysis by Van Etten and Taylor (1998) who concluded that although the effect sizes were equivalent in CBT and EMDR, number of sessions in EMDR was significantly fewer. However, this

analysis did not restrict itself to studies that compared each therapy under identical conditions. A meta-analysis by Seidler and Wagner (2006) was conducted to rectify this issue and only randomised control trials that contained each treatments was included in the data. They found no advantage for one treatment approach over the other. They also did not venture into investigating the "efficiency" statement put forth by Van Etten and Taylor (1998) as there was significant heterogeneity in their results

Since the publication of Seidler and Wagner's (2006) paper, there have been more studies which directly compare EMDR and TFCBT. This allows for active-active comparisons and as such it seemed appropriate to conduct a new meta-analysis, the aim of which is to compare the treatment outcomes of EMDR with exposure-based CBT treatments for PTSD. Homework hours will be used as a moderator variable to investigate the extent to which it influences the validity of which treatment may be more *efficient*. It is proposed that an exploration of this discrepancy could offer further insights into EMDR and add to the conjecture on whether EMDR is a variant of TFCBT, or a distinct treatment modality with its own key processes and mechanisms.

Method

Literature Search

Potentially relevant trials were identified via the following electronic databases: Medline (PSS-SR; National Library of Medicine, 1999), PsycINFO (American Psychological Association, 2010b), PsycARTICLES (American Psychological Association, 2010a) and Ebscohost (Ebsco Publishing, 2010). The search was conducted using the search terms

EMDR or eye movement and randomised outcome or randomized outcome or controlled study or CBT. Additional studies were identified by manual search of past meta-analyses and recent reviews (Adler-Tapia & Settle, 2009; Benish, Imel, & Wampold, 2008; Bisson et al., 2007; Davidson & Parker, 2001; Rodenburg, Benjamin, de Roos, Meijer, & Stams, 2009; Seidler & Wagner, 2006; Van Etten & Taylor, 1998). These findings where then cross-checked with the EMDR institute website's extensive reference section to ensure that all pertinent studies were located (EMDR Institute, 2004).

Inclusion/exclusion criteria

Studies were selected for inclusion if they met at least four out of the seven gold standards for PTSD treatment outcome research as identified by Foa and Meadows (1997). The standards are as follows: (1) clearly defined symptoms of significant trauma-related psychopathology; (2) reliable and valid measures; (3) use of independent (blind) evaluators; (4) trained assessors; (5) manualised, replicable, specific treatment programs; (6) unbiased assignment to treatment; and (7) treatment adherence. The first two standards were considered an absolute requirement for inclusion to ensure that the studies chosen were comparing treatment outcomes of the same psychological condition and used measures with good psychometric properties that had the ability to assess symptom severity (Foa & Meadows, 1997).

Inclusion of Studies

The four electronic searches and 6 articles resulted in 119 unique studies. Of these, 45 were excluded because they were review papers only. A further 41 were excluded because they were either a case report or EMDR was not compared directly with exposure based CBT. Ten

studies were eye movement only studies and 1 article was published in a language other than English. Thus a total of 21 studies were retrieved for more detailed evaluation and 5 studies were excluded as the participants had no clear PTSD diagnosis (e.g. Wanders, Serra, & de Jongh, 2008), 4 studies were excluded due to their design (additive or non-randomised; e.g. Karatzias et al., 2007), 3 were excluded as the comparative treatment was not clearly defined or not compared directly with exposure based CBT (e.g. Edmond, Rubin, & Wambach, 1999) and 1 study was excluded as the participants were children (Jaberghaderi, Greenwald, Rubin, Zand, & Dolatabadi, 2004). In total, 8 studies were located that satisfied the inclusion criteria. Table 1 summarises these studies in terms of their methodological qualities based on Foa and Meadows' (1997) seven gold standards.

[Insert table 1 here]

Analyses

The following measures from the 8 studies were drawn upon for the calculation of PTSD effect sizes: (1) Impact of Event Scale (IOE; Horowitz, Wilner, & Alvarez, 1979); (2) SI PTSD Symptom Checklist (Davidson, Smith & Kudler, 1989); (3) Clinician Administered PTSD subscales (Blake et al., 1997); (4) PTSD Symptom Severity Scale (PTSD SS; Foa, 1995); (5) Revised Symptom Checklist-90 (SCL-90-R; Derogatis, 1992); (6) Subject Units of Distress Scale (SUDS; Wolpe, 1969); (7) Civilian Mississippi Scale for PTSD (CMS; Keane, Caddell, & Taylor, 1988); (8) PTSD Symptom Scale–Self-Report (PSS-SR; Foa, Riggs, Dancu, & Rothbaum, 1993); (9) PTSD Interview (PTSD-I; Watson, Juba, Manifold, Kucala, & Anderson, 1991); (10) Dissociative Experiences Scale-II (DES-II; Bernstein & Putnam, 1986); (11) State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970);

and (12) Keane's Post-Traumatic Stress Disorder Scale from the Minnesota Multiphasic Personality Inventory (MMPI-K; Keane, et al., 1988).

For the calculation of depression effect sizes, the following measures' post-test scores were used: (1) Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961); (2) Beck Depression Scale (BECK-D; Beck, 1987); (3) Montgomery Asberg Depression Rating Scale (MADRS; Montgomery & Asberg, 1979); (4) The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983); and (5) the Hamilton Rating Scale for Depression (HRSD; Hamilton, 1960).

For each of the studies, effect sizes were calculated using the computer program Comprehensive Meta-analysis; version 2 (CMA; Borenstein, Hedges, Higgins, & Rothstein, 2005). The mean and standard deviation of each intervention's (EMDR or CBT) post-test score for each of their chosen outcome measures was entered into CMA. Where means and standard deviations were not reported, *p*-values were used instead. This occurred for three studies: Johnson and Lubin, (2006), Rothbaum, Astin and Marsteller, (2005) and Taylor et al., (2003). The *p*-values were computed via a syntax file created in SPSS using the reported *F*-ratio or *t*-value and the degrees of freedom as sourced from the analyses stated in the results section of each of the studies (see table 2 for a list of values taken from each of the studies).

[Insert table 2 here]

Both the random- and the fixed-effects models were examined to see whether any discrepancies would materialize. The fixed-effects model assumes that the studies included come from the entire population that you are interested in, whilst the random-effects model assumes that the studies included in the meta-analysis represent only a sample of that particular population; therefore each study brings with it a certain amount of heterogeneity (Whitehead, 2002). Where there is significant heterogeneity that cannot be explained by observed moderators, Hedges and Vevea (1998) recommend using the random-effects model data instead. Heterogeneity indicated by the I^2 statistic, which yields heterogeneity in percentages (0% = no, 25% = low, 50 = moderate, 75% = high heterogeneity of effect size) was calculated using CMA.

A funnel plot on primary outcome measures and Duval and Tweedie's trim and fill method (Duval & Tweedie, 2000) was used to evaluate the studies for publication bias. Again, this was accomplished via the CMA software (Borenstein, et al., 2005).

Homework hours and session times

The number of prescribed homework hours and session times for each of the treatment modalities was determined to ensure that an accurate time ratio could be calculated. Where hours of homework and session times were not clearly defined in the papers (e.g. Jaberghaderi, et al., 2004), the treatment manuals were acquired and two postgraduate research students were engaged to calculate the total number of prescribed homework hours for each study condition (e.g. EMDR or TFCBT) and the total number of hours spent in

session. Each study was discussed until a consensus was reached and these ratings were used in the final calculation of the ratio (see table 3).

[Insert table 3 here]

Results

Description of included studies – PTSD and Depression

The 8 studies comparing EMDR with exposure based CBT refer to a total of 227 participants (116 in the EMDR condition and 111 in the CBT condition; average age = 35.64). Out of the 8 studies, 7 were not trauma specific populations (i.e. participants reported a range of different and sometimes multiple trauma experiences), and 1 study was limited to female victims of rape (Rothbaum, et al., 2005).

Effect sizes

The results indicating the difference between EMDR and exposure-based CBT on PTSD only measures are presented in Table 4 and plotted in Figure 1 along with the effect sizes and 95% confidence intervals for the individual studies. The mean effect size indicating the differences between EMDR and exposure based CBT is small and not statistically significant (Hedge's g = 0.23; fixed effects model; 95% CI: -0.032-0.491). As there was minimal heterogeneity (I^2 = 7.637) the fixed effects model was used.

[Insert table 4 here]

[Insert figure 1 here]

The effect sizes for the depression symptoms ranged from -0.784 to 1.291 (see Figure 2 and Table 3) and the mean effect size was moderate according to Hedge's g = 0.633 (fixed effects model; 95% CI: 0.369 – 0.897) with moderate heterogeneity (I^2 = 53.90). The effect size is significant at a .01 level; p = 0.000, which suggests that EMDR may be useful for PTSD patients who are experiencing symptoms of depression.

[Insert figure 2 here]

Publication Bias

Inspection of the funnel plot and Duval and Tweedie's (2000) trim-and-fill procedure revealed that when the standard error was plotted there were no noticeable outliers for the PTSD outcome measures. However, there were 2 outliers for the depression measures' funnel plot; whereby 2 studies' 95% confidence intervals fell outside the 95% confidences intervals of the pooled effect size (Devilly & Spence, 1999; Taylor, et al., 2003). These 2 studies were removed and the mean effect size was recalculated revealing a large effect – Hedge's g = 0.910 (fixed effects model; 95% CI: 0.551 – 1.268) with zero heterogeneity (see Table 4).

Differences in Homework

There were reported differences in the amount of prescribed homework. The mean number of homework hours for CBT was approximately 23 plus or minus 10.58 hours (SD) and the mean number of homework hours for EMDR was approximately 2.65 plus or minus 4.02 hours (SD). An indication of the effect size per hour of treatment was calculated. Standard effect sizes from pre-treatment to post-treatment were calculated using Cohen's d (the difference between the two comparison conditions' means divided by the pooled standard

deviation) and effect size per hour was calculated by dividing the total effect size for each of the conditions by the number of hours of homework and multiplying by 100. Figure 3 illustrates the obtained difference between these two conditions.

[Insert figure 3 here]

Meta-regression Analyses - Homework

In a meta-regression analysis, we tested whether the mean PTSD effect size related to time spent in session and doing homework. A time ratio was calculated for all 8 studies by combining session hours and homework hours of CBT and then dividing this amount by the sum of session and homework hours of EMDR. The time ratio did not relate significantly to the PTSD effect sizes (p =.91) with the point estimate of the slope at 0.012 (95% CI:-0.22 – 0.24).

We conducted another meta-regression – this time to investigate whether or not the depression symptoms effect size would be related to the time ratio as described above, but using only 6 of the studies (recall 2 studies were considered to be outliers as evidenced by the publication bias funnel plot: Devilly & Spence, 1999; Taylor et al., 2003). The analyses revealed that the time ratio related significantly to the pooled effect size as evidenced by the intercept p-value (p = .012). The point estimate of the slope was -0.094 (95% CI: - 0.415 – 0.22).

Discussion

The purpose of this meta-analysis was to provide an up-to-date investigation of whether or not treatment outcomes for EMDR and trauma-focused CBT differ in efficacy and to also extend the clinical field further by trying to understand the role that homework plays with

respect to treatment efficiency. Eight randomised control studies which directly compare EMDR with CBT approaches in PTSD populations yielded similar effect sizes. Six of the studies also investigated depression outcomes and a large effect size emerged, revealing that EMDR is may be more advantageous for PTSD patients experiencing co-morbid depression. Heterogeneity was moderate in the initial calculation of the depression effect size data and after the removal of 2 outliers, it was reduced to zero.

There was no significant association between the time ratio and the PTSD effect sizes indicating that homework is not a moderator in this instance and it would appear that EMDR as a treatment for PTSD is equivalent to CBT irrespective of number of hours of homework assigned/completed. It could therefore be argued that homework is not a requirement for clients undergoing EMDR as the results would still be comparable. It is interesting to note however that when the meta-regression was conducted with the depression effect sizes, a significant association was observed. This is difficult to know what this result may mean since the regression does not look independently at homework and treatment effects. A direct comparison between the two treatments with high and low doses of homework is needed to tease out this effect.

The results of the current study are at odds with an earlier meta-analysis conducted by Seidler & Wagner, (2006) which did not find any differences between EMDR and TFCBT for patients with PTSD with or without co-morbid depression. The difference may in part be accounted for by the inclusion of a more recent paper in the current analysis, and in rejecting papers that contributed significantly to the heterogeneity of the findings. The authors admit that there was significant heterogeneity in their meta-analysis, but did not investigate further

due to the small number of studies. Heterogeneity was minimal in the current study with respect to the initial analysis which was used to calculate the effect size for the PTSD outcome data and adjusted for the co-morbid depression data whereby 2 outliers were removed and this still returned a significant effect size. Caution should be exercised though when interpreting the results as the number of studies included in this meta-analysis is still relatively small as are the sample sizes of the individual studies. An argument could also be made that the random effects model would have been appropriate, but given the low heterogeneity, it seemed acceptable to use the fixed effects model. The finding that EMDR can improve symptoms of depression has been noted in independent reviews of the evidence for the effectiveness of EMDR (NREPP: http://nrepp.samhsa.gov/ViewIntervention.aspx?id=199).

The finding of a non-significant effect for EMDR over TFCBT is not surprising as both are effective treatments for PTSD and this is in line with other meta-analyses such as Bisson (2007) and Davidson & Parker (2001). What is surprising however, is that EMDR achieves its results without copious hours of homework which is an essential part of TFCBT (Rothbaum, et al., 2005). If more treatment (session plus homework) is required for a better outcome – then why wasn't there an effect size difference in favour of TFCBT?

Indeed when Scott and Stradling (1997) investigated two CBT-based treatments: image habituation training (IHT) and prolonged exposure (PE) in PTSD patients they found that those who completed the homework showed improvements over those who did not. Both Marks et al., (1998) and Richards et al., (1994) reported similar findings with respect to

homework compliance and treatment outcomes. Furthermore in studies which have used CBT-based approaches with trauma populations and there have been no homework tasks, the experimental group reported more physical symptoms (Batten, Follette, Rasmussen Hall, & Palm, 2002), and more health care visits and avoidance symptoms than the control group at follow-up (Gidron, Peri, Connolly, & Shalev, 1996). It appears that homework is required in CBT-based approaches as consolidation is not completed in-session and requires extra self-guided tasks to promote habituation (Dozois, 2010).

Compliance rates for homework completion are low in most clinical populations and PTSD groups are no exception (Shapiro, 2001). Scott and Stradling (1997) report that only 7% of participants completed their homework in the prescribed manner in the IHT group and 56% of participants fulfilled the homework requirements in the PE group. The authors observed that the participants with more severe symptoms and co-morbid depression were less likely to comply with homework tasks. This is concerning as CBT-based approaches are not as successful without a homework component (Kazantzis & Lampropoulos, 2002) and this may be especially so for clients with a trauma history (Baikie & Wilhelm, 2005). As a consequence, even though CBT is efficacious for PTSD patients it may not be the most appropriate treatment (Scott & Stradling, 1997).

Thus, if homework is an unnecessary component of EMDR and it is equivalent to TFCBT then there is an efficiency argument in favour of EMDR. This was highlighted in the current data by the difference in prescribed homework between the two treatments and the calculation of an effective size per hour.

A major controversy remains when considering the treatment of choice for PTSD. To date we still have no clear understanding on the role of eye movements in the treatment process. It is possible that the eye movements promote an orienting response to the trauma by allowing the patient to confront the memory which becomes less threatening as the patient has to divide their attention between a motor task and the task of holding the visualisation of the trauma in their memory. That is, initially the traumatic memory may be upsetting and cause the person to initiate a "what-is-it" reflex. When there is no imminent threat, the patient's sympathetic nervous system responds accordingly. A recent study by Schubert, Lee and Drummond (2010) confirmed this by measuring autonomic changes experienced by a non-clinical sample randomly assigned to a single session of EMDR with (fixed or varied pace) or without eye movements. They found that EMDR with eye movements was not only associated with reduction in distress over negative memories but also significant decreases in heart rate at the onset and skin conductance during eye movement sets. This relaxation response (which is incompatible with anxiety) is paired with the traumatic memory which reduces avoidance and allows the memory to be processed sufficiently. The relaxation response primed by the eye movements in EMDR is clinically meaningful as it may moderate arousal during treatment. Thus, EMDR may be particularly apt for patients who are unable to tolerate the distress caused by exposure and who are unlikely to engage in homework tasks for the same reasons. An alternative to the orienting response is that to store trauma memories in an episodic form taxes working memory and that eye movements competes with such memories for the limited storage capacity which then results in reductions in vividness and subsequently emotional ratings (I. M. Engelhard, M. A. van den Hout, & M. A. M. Smeets, 2011; van den Hout et al., 2011; van den Hout et al., 2010)

EMDR is efficacious for PTSD and trauma patients with or without co-morbid depression and requires little –to- no between session tasks to ensure positive outcomes. This evidence can be added to the growing list of differences between EMDR and CBT that others have also noted including the way exposure is employed in each of the 2 treatment modalities, EMDR's non-directive approach, and the encouragement of free association during trauma recall and distancing. Despite these differences it is still not clear as to why homework is not required and what mechanisms are behind EMDR's observed efficiency. Further exploration of this area may help to identify relevant treatment mechanisms .

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